WHAT IS CLAIMED IS:

A method for restoring a virtual path in an optical network, the method comprising:

- broadcasting a plurality of resource request packets to a
 plurality of nodes in said optical network;
 identifying a plurality of nodes with resources wherein said
 nodes with resources are ones of said nodes having a
 resource necessary to support said virtual path;

 determining an alternate physical path, said alternate physical
 path comprising ones of said nodes with resources;
 configuring said alternate physical path by establishing a
 communication connection between said ones of said
 nodes with resources; and

 restoring said virtual path by provisioning said virtual path over
 - 2. The method of claim 1, further comprising: detecting a failure in said virtual path;

said alternate physical path.

3. The method of claim 2, wherein: said detection of said failure is done by receiving a failure message packet;

said identification of said nodes with resources is done by
acknowledging said failure message packet; and
said determination of said nodes with resources is done by
analyzing a response to said resource request packets.

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- The method of claim 2, wherein: 4. said virtual path is provisioned on a physical path between a first and a second/node of said optical network; said optical network comprises said nodes; and each one of said nodes is coupled to at least one another of said nodes by a plurality of optical links.
- The method of claim 4, wherein: 5. said physical path between said first and said second node comprises a plurality of intermediate nodes.
- 10 6. The method of claim 4, wherein each one of said nodes is coupled to at least one another of said nodes in a mesh topology.
 - 7. The method of claim 6, wherein said restoring of said virtual path is completed in less than 2 seconds
- 8. The method of claim 6, wherein said restoring of said virtual path is 15 completed in less than 250 milliseconds.
 - 9. The method ϕ f claim 6, wherein said restoring of said virtual path is completed in less than 50 milliseconds.
 - 10. The method of claim 6, wherein said restoring of said virtual path by is performed by said first node.
- 20 11. The method of claim 10, further comprising: if said failure is a local physical port failure between said first node and an adjacent node, determining an available different physical port of said link between said first node and said adjacent 25 nodes,

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initiating a physical port switch request for said adjacent node, provisioning said virtual path to said different physical port, and updating said provisioning information in a node database.

12. The method of claim 11, further comprising: if different physical port of said link between said first node and said adjacent nodes is unavailable,

- (i) changing a state of said virtual path to restoring,
- (ii) identifying a plurality of adjacent nodes with required bandwidth for said virtual path,
- (iii) forwarding a path restoration request to said
 plurality of adjacent nodes with required bandwidth
 for said virtual path, and
- (iv) waiting for a response for said path restoration request for a first predetermined time interval.
- 13. The method of claim 12, further comprising:
 if said response to said path restoration request is not received within said first predetermined time interval,
 repeating steps (ii) (iv) for a second predetermined time interval.
- 14. The method of claim 13, further comprising: if said response is not receive in within said second predetermined time interval, generating network alarms.
- 15. The method of claim 14, wherein said first and said second predetermined time intervals are defined during provisioning of said virtual path.

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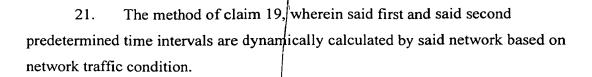
- 16. The method of claim 14, wherein said first and said second predetermined time intervals are dynamically calculated by said network based on network traffic condition.
 - 17. The method of claim 10, further comprising:

 if said failure did not occur at a physical port of said link

 between said first node and one of adjacent nodes of
 said first node,
 - (i) changing a state ϕ f said virtual path to restoring,
 - (ii) identifying a plurality of adjacent nodes with required bandwidth for said virtual path,
 - (iii) forwarding a path restoration request to said plurality of adjacent nodes with required bandwidth for said virtual path, and
 - (iv) waiting for a response for said path restoration request for a first predetermined time interval.
 - 18. The method of claim 17, further comprising: if said response for said path restoration request is not receive within said first predetermined time interval, repeating steps (ii) (iv) for a second predetermined time interval.
 - 19. The method of claim 18, further comprising: if said response for said path restoration request is not received with in said second predetermined time interval, generating network alarms.
- 25 20. The method of claim 19, wherein said first and said second predetermined time intervals are defined during provisioning of said virtual path.

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- 22. The method of claim 6, wherein said restoring of said virtual path is performed by one of said intermediate nodes.
 - 23. The method of claim 22, wherein said failure is a local physical port failure between said intermediary node and an adjacent node comprising said virtual path.
 - 24. The method of claim 23, further comprising: determining an available different physical port of said link between said intermediary node and said adjacent nodes:

initiating a physical port switch request for said adjacent node; provisioning said virtual path to said different physical port; and

updating said provisioning information in a node database.

- 25. The method of claim 24, further comprising: if different physical port of said link between said intermediary node and said adjacent nodes is unavailable,
 - a. changing a state of said virtual path to down,
 - b. generating a restoration request,
 - c. forwarding said restoration request to a plurality of adjacent nodes comprising said virtual path, and
 - d. waiting for a response to said restoration request for a predetermined interval of time.

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- 26. The method of claim 25, further comprising: if said response to said restoration request is not received within said predetermined interval of time, repeating steps (b) (d) for a predefined threshold times.
- 27. The method of claim 26, further comprising: if said response to said restoration request is not received within said predefined threshold times, releasing resources of said virtual path.
- 28. The method of claim 27, wherein said predetermined interval of time and said predefined threshold are defined during provisioning of said virtual path.
- 29. The method of claim 27, wherein said predetermined interval of time and said predefined threshold are dynamically calculated by said network based on network traffic condition.
 - 30. The method of claim 26, further comprising: if said response to said restoration request is received, releasing resources of said virtual path.
 - 31. The method of claim 22, further comprising:
 if said intermediary node receives a message of a remote port
 failure at a node comprising said virtual path,
 changing a state of said virtual path to down,
 forwarding said message to a plurality of adjacent nodes
 comprising said virtual path, and
 initiating a timer for receiving a response to said
 forwarded message.

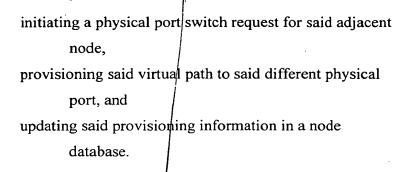
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	32. The method of claim 31, further comprising:
	if said timer expires before said response to said forwarded
	message is received,
	releasing resources of said virtual path.
5	33. The method of claim 31, further comprising:
	if said response to said forwarded message is received,
	releasing resources of said virtual path.
	34. The method of claim 22, further comprising:
	if said intermediary node receives a valid restore path request,
10	updating path information in a node database,
	allocating resources requested for said virtual path, and
	forwarding said restore path request to all eligible
	adjacent nodes
	35. The method of claim 22, further comprising:
15	if said intermediary node receives an invalid restore path
	request,
	responding with a negative acknowledgment.
	36. The method of claim 6, wherein restoring of said virtual path is
	performed by said second node.
20	37. The method of claim 36, further comprising:
	if said failure is a local physical port failure between said
	second node and an adjacent node comprising said
	virtual path,
	determining an available different physical port of said
25	link between said second node and said adjacent
	nodes,

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38. The method of claim \$7, further comprising: if different physical port of said link between said second node and said adjacent nodes is unavailable,

a. changing a state ϕ f said virtual path to down,

b. generating a restoration request,

- c. forwarding said restoration request to a plurality of adjacent nodes comprising said virtual path, and
- d. waiting for a response to said restoration request for a predetermined interval of time.

39. The method of claim 38, further comprising: if said response to said restoration request is not received within said predetermined interval of time, repeating steps (b) – (d) for a predefined threshold times.

40. The method of claim 39, further comprising: if said response to said restoration request is not received within said predefined threshold times, releasing resources of said virtual path.

25 41. The method of claim 40, wherein said predetermined interval of time and said predefined threshold are defined during provisioning of said virtual path.

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- 42. The method of claim 40, wherein said predetermined interval of time and said predefined threshold are dynamically calculated by said network based on network traffic condition.
- 43. The method of claim 39, further comprising: if said response to said restoration request is received, releasing resources of said virtual path.
 - 44. The method of claim 36, further comprising:
 if said second node receives a message of a remote port failure
 at a node comprising said virtual path,
 acknowledging said message,
 changing a state of said virtual path to down, and
 releasing resources of said virtual path.
 - 45. The method of claim 36, further comprising: if said second node receives a valid restore path request, updating path information in a node database, and allocating resources requested for said virtual path.
 - 46. The method of claim 36, further comprising: if said second node receives an invalid restore path request, responding with a negative acknowledgment.
- 47. A computer system comprising:

 a processor;
 an optical network interface, coupled to said processor and to an optical network;
 computer readable medium coupled to said processor; and

 25 computer code, encoded in said computer readable medium, configured to cause said processor to:

 broadcast a plurality of resource request packets to a

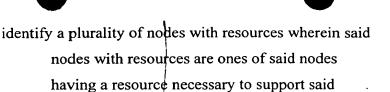
plurality of said nodes in said optical network;

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virtual path;

determine an alternate physical path, said alternate physical path comprising ones of said nodes with resources;

configure said alternate physical path by establishing a communication connection between said ones of said nodes with resources; and restore said virtual path by provisioning said virtual

path over said alternate physical path.

48. The computer system of claim 47, wherein said computer code configured to cause said processor to:

detect a failure in said virtual path

49. The computer system of claim 47, wherein said computer code configured to cause said processor to restore said virtual path is further configured to cause said processor to:

complete restoration of said virtual path in less than 50 milliseconds.

50. The computer system of claim 47, wherein: said virtual path is provisioned on a physical path between a first and a second node of said optical network; said optical network comprises said nodes; and each one of said nodes is coupled to at least one another of said nodes by a plurality of optical links.

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- 51. The computer system of claim 50, wherein: said physical path between said first and said second node comprises a plurality of intermediate nodes.
- 52. The computer system of claim 50, wherein each one of said nodes is 5 coupled to at least one another of said nodes in a mesh topology.
 - 53. The computer system of claim 52, wherein said computer code is configured to cause said processor to perform said restoring of said virtual path at said first node.
- 54. The computer system of claim 53, wherein said computer code 10 configured to cause said processor to:

if said failure is a local physical port failure between said first node and an adjacent hode,

> determine an available different physical port of said link between said first node and said adjacent nodes.

initiate a physical port switch request for said adjacent node,

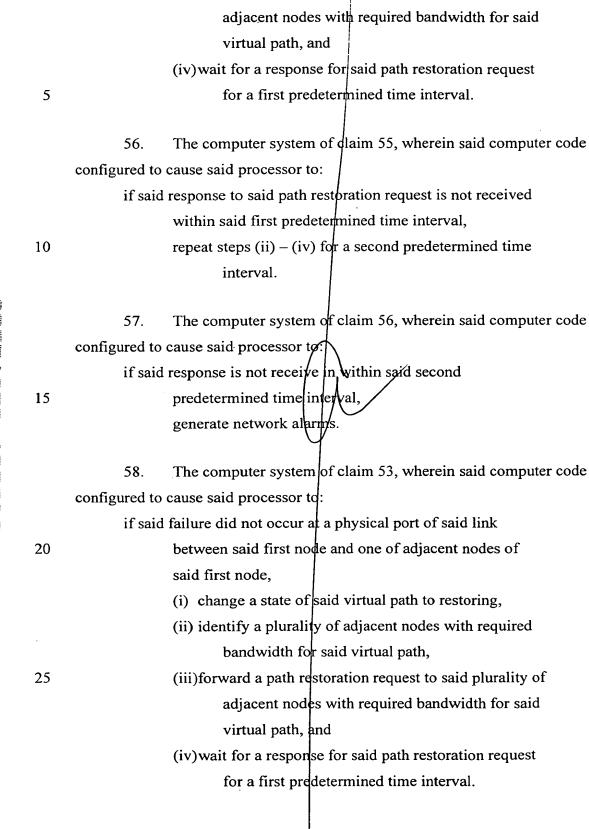
provision said virtual path to said different physical port, and

update said provisioning information in a node database.

The computer system of claim 54, wherein said computer code 55. configured to cause said processor to:

if different physical port of said link between said first node and said adjacent nodes is unavailable,

- (i) change a state φf said virtual path to restoring,
- (ii) identify a plurality of adjacent nodes with required bandwidth for said virtual path,



(iii) forward a path restoration request to said plurality of

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The computer system of claim 58, wherein said computer code 59. configured to cause said processor to: if said response for said path restoration request is not receive within said first predetermined time interval, repeat steps (ii) – (iv) for a second predetermined time interval. 60. The computer system of claim 59, wherein said computer code configured to cause said processor to: if said response for said path restoration request is not received with in said second predetermined time interval, generate network alarms. The computer system of claim 52, wherein said computer code 61. configured to cause said processon to perform said restoring of said virtual path at one of said intermediate nodes. The computer system of claim 61, wherein said computer code 62. configured to cause said processor to: if said failure is a local physical port failure between said intermediary node and an adjacent node comprising said virtual path, determine an available different physical port of said link between said intermediary node and said adjacent nodes, initiate a physical port switch request for said adjacent node, provision said virtual path to said different physical port, and

update said provisioning information in a node

database.

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63. The computer system of claim 62, wherein said computer code configured to cause said processor to:

if different physical port of said link between said intermediary node and said adjacent nodes is unavailable,

a. change a state of said virtual path to down,

.

b. generate a restoration request,

c. forward said restoration request to a plurality of adjacent nodes comprising said virtual path, and

d. wait for a response to said restoration request for a predetermined interval of time.

64. The computer system of claim 63, wherein said computer code configured to cause said processor to:

if said response to said restoration request is not received within said predetermined interval of time, repeat steps (b) – (d) for a predefined threshold times.

65. The computer system of claim 64, wherein said computer code configured to cause said processor to:

if said response to said restoration request is not received within said predefined threshold times, release resources of said virtual path.

66. The computer system of claim 64, wherein said computer code configured to cause said processor to:

if said response to said restoration request is received, release resources of said virtual path.

25 67. The computer system of claim 61, wherein said computer code configured to cause said processor to:

if said intermediary node receives a message of a remote port failure at a node comprising said virtual path, change a state of said virtual path to down,

forward said message to a plurality of adjacent nodes comprising said virtual path, and initiate a timer for receiving a response to said forwarded message.

5 68. The computer system of claim 67, wherein said computer code configured to cause said processor to:

if said timer expires before said response to said forwarded message is received, release resources of said virtual path.

10 69. The computer system of claim 67, wherein said computer code configured to cause said processor to:

if said response to said forwarded message is received, release resources of said virtual path.

70. The computer system of claim 61, wherein said computer code configured to cause said processor to:

if said intermediary node receives a valid restore path request,
update path information in a node database,
allocate resources requested for said virtual path, and
forward said restore path request to all eligible adjacent

20 nodes.

71. The computer system of claim 61, wherein said computer code configured to cause said processor to:

if said intermediary node receives an invalid restore path request,

respond with a negative acknowledgment.

72. The computer system of claim 52, wherein said computer code configured to cause said processor to perform said restoring of said virtual path at said second node.

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73. The computer system of claim 72, wherein said computer code configured to cause said processor to:

if said failure is a local physical port failure between said second node and an adjacent node comprising said

virtual path,

determine an available different physical port of said link between said second node and said adjacent nodes.

initiate a physical port switch request for said adjacent node,

provision said virtual path to said different physical port, and

update said provisioning information in a node database.

74. The computer system of claim 73, wherein said computer code configured to cause said processor to:

if different physical port of said link between said second node and said adjacent nodes is unavailable,

- a. change a state of said virtual path to down,
- b. generate a restoration request,
- c. forward said restoration request to a plurality of adjacent nodes comprising said virtual path, and
- d. wait for a response to said restoration request for a predetermined interval of time.
- The computer system of claim 72, wherein said computer code configured to cause said processor to:

if said response to said restoration request is not received within said predetermined interval of time, repeat steps (b) + (d) for a predefined threshold times.

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76. The computer system of claim 75, wherein said computer code configured to cause said processor to:

if said response to said restoration request is not received within said predefined threshold times, release resources of said virtual path.

77. The computer system of claim 75, wherein said computer code configured to cause said processor to:

if said response to said restoration request is received, release resources of said virtual path.

78. The computer system of claim 72, wherein said computer code configured to cause said processor to:

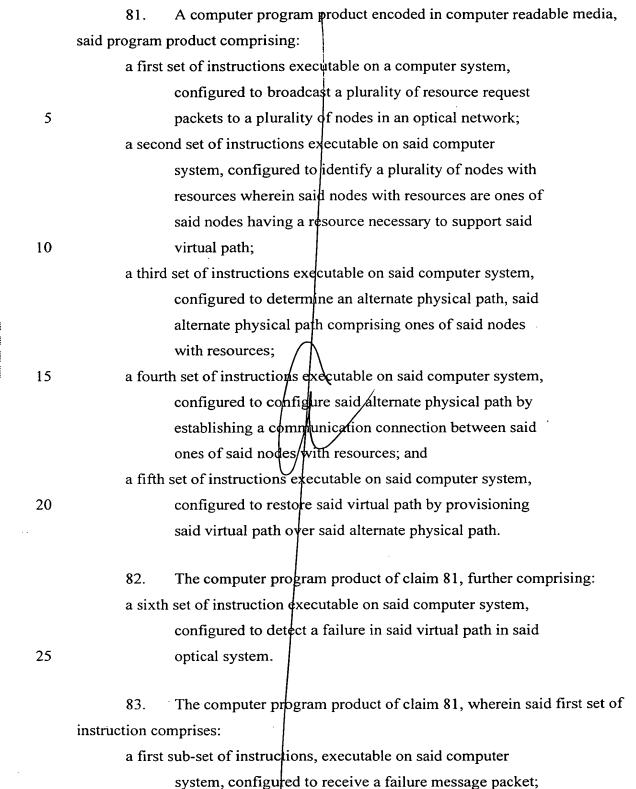
if said second node receives a message of a remote port failure at a node comprising said virtual path, acknowledge said message, change a state of said virtual path to down, and release resources of said virtual path.

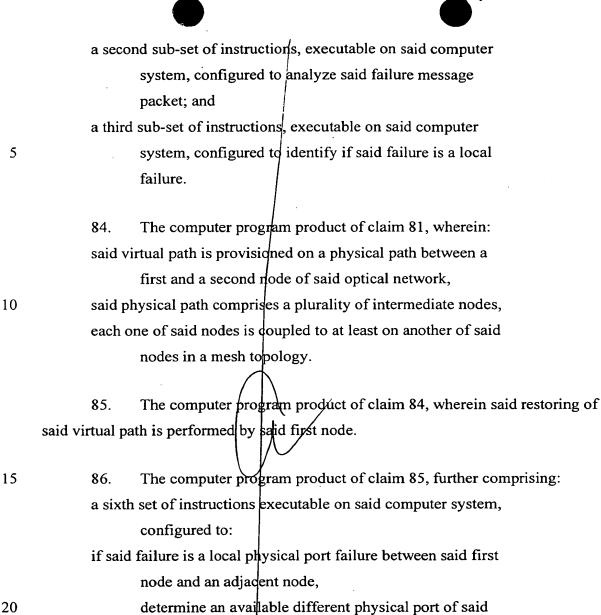
79. The computer system of claim 72, wherein said computer code configured to cause said processor to:

if said second node receives a valid restore path request, update path information in a node database, and allocate resources requested for said virtual path.

80. The computer system of claim 72, wherein said computer code configured to cause said processor to:

if said second node receives an invalid restore path request, respond with a negative acknowledgment.





node,
provision said virtual path to said different physical
port, and
update said provisioning information in a node

initiate a physical port switch request for said adjacent

nodes,

database.

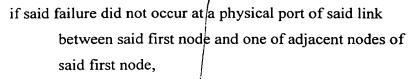
link between said first node and said adjacent

a seventh set of instructions executable on said computer system, configured to: if different physical port of said link between said first node and said adjacent nodes is unavailable, (i) change a state of said virtual path to restoring, (ii) identify a plurality of adjacent nodes with required bandwidth for said virtual path, (iii) forward a path restoration request to said plurality of adjacent nodes with required bandwidth for said virtual path, and (iv) wait for a response for said path restoration request for a first predetermined time interval. 88. The computer program product of claim 87, further comprising: an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
if different physical port of said link between said first node and said adjacent nodes is unavailable, (i) change a state of said virtual path to restoring, (ii) identify a plurality of adjacent nodes with required bandwidth for said virtual path, (iii) forward a path restoration request to said plurality of adjacent nodes with required bandwidth for said virtual path, and (iv) wait for a response for said path restoration request for a first predetermined time interval. 88. The computer program product of claim 87, further comprising: an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
and said adjacent nodes is unavailable, (i) change a state of said virtual path to restoring, (ii) identify a plurality of adjacent nodes with required bandwidth for said virtual path, (iii) forward a path restoration request to said plurality of adjacent nodes with required bandwidth for said virtual path, and (iv) wait for a response for said path restoration request for a first predetermined time interval. 88. The computer program product of claim 87, further comprising: an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
 (i) change a state of said virtual path to restoring, (ii) identify a plurality of adjacent nodes with required bandwidth for said virtual path, (iii) forward a path restoration request to said plurality of adjacent nodes with required bandwidth for said virtual path, and (iv) wait for a response for said path restoration request for a first predetermined time interval. 88. The computer program product of claim 87, further comprising: an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
 (ii) identify a plurality of adjacent nodes with required bandwidth for said virtual path, (iii) forward a path restoration request to said plurality of adjacent nodes with required bandwidth for said virtual path, and (iv) wait for a response for said path restoration request for a first predetermined time interval. 88. The computer program product of claim 87, further comprising: an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) – (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
bandwidth for said virtual path, (iii)forward a path restoration request to said plurality of adjacent nodes with required bandwidth for said virtual path, and (iv)wait for a response for said path restoration request for a first predetermined time interval. 88. The computer program product of claim 87, further comprising: an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
 (iii) forward a path restoration request to said plurality of adjacent nodes with required bandwidth for said virtual path, and (iv) wait for a response for said path restoration request for a first predetermined time interval. 88. The computer program product of claim 87, further comprising: an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
adjacent nodes with required bandwidth for said virtual path, and (iv) wait for a response for said path restoration request for a first predetermined time interval. 88. The computer program product of claim 87, further comprising: an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval. 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
path, and (iv) wait for a response for said path restoration request for a first predetermined time interval. 88. The computer program product of claim 87, further comprising: an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
 (iv) wait for a response for said path restoration request for a first predetermined time interval. 88. The computer program product of claim 87, further comprising: an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) – (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
first predetermined time interval. 88. The computer program product of claim 87, further comprising: an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
88. The computer program product of claim 87, further comprising: an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) – (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
an eighth set of instructions executable on said computer system, configured to: if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) – (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
if said response to said path restoration request is not received within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
within said first predetermined time interval, repeat steps (ii) — (iv) for a second predetermined time interval 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
repeat steps (ii) – (iv) for a second predetermined time interval. 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
interval. 89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
89. The computer program product of claim 86, further comprising: a ninth set of instructions executable on said computer system, configured to:
a ninth set of instructions executable on said computer system, configured to:
a ninth set of instructions executable on said computer system, configured to:
configured to:
<u> </u>
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if said response is not receive in within said second
predetermined time interval,
generate network alarms.
90. The computer program product of claim 85, further comprising:
a sixth set of instructions executable on said computer system,
configured to:

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- (i) changing a state of said virtual path to restoring,
- (ii) identifying a plurality of adjacent nodes with required bandwidth for said virtual path,
- (iii) forwarding a path restoration request to said plurality of adjacent nodes with required bandwidth for said virtual path, and
- (iv) waiting for a response for said path restoration request for a first predetermined time interval.
- 91. The computer program product of claim 90, further comprising: a seventh set of instructions executable on said computer system, configured to:

if said response for said path restoration request is not receive within said first predetermined time interval, repeat steps (ii) – (iv) for a second predetermined time interval

92. The computer program product of claim 90, further comprising: an eighth set of instructions executable on said computer system, configured to:

if said response for said path restoration request is not received with in said second predetermined time interval, generate network alarms.

- 25 93. The computer program product of claim 84, wherein said restoring of said virtual path is performed by one of said intermediate nodes.
 - 94. The computer program product of claim 93, further comprising: a sixth set of instructions executable on said computer system, configured to:



if said	l failure is a local port failu	re between said intermediary
	node and an adjacent nod	de comprising said virtual path,
	determine an available di	ifferent physical port of said
	link between said	intermediary node and said
	adjacent nodes,	
	initiate a physical port sv	vitch request for said adjacent
	nóde,	
	provision said virtual pat	th to said different physical
	port, and	
	updat said provisioning is	nformation in a node database.
95.	The computer program p	roduct of claim 94, further comprising:
a seve	enth set of instructions exec	cutable on said computer
	system, configured to:	

if different physical port of said link between said intermediary node and said adjacent nodes is unavailable,

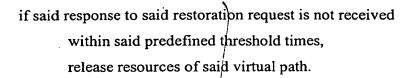
- a. change a state of said virtual path to down,
- b. generate a restoration request,
- c. forward said restoration request to a plurality of adjacent nodes comprising said virtual path, and
- d. wait for a response to said restoration request for a predetermined interval of time.
- 96. The computer program product of claim 95, further comprising: an eighth set of instructions executable on said computer system, configured to:
- if said response to said restoration request is not received within said predetermined interval of time, repeat steps (b) (d) for a predefined threshold times.
- 97. The computer program product of claim 96, further comprising: a ninth set of instructions executable on said computer system, configured to:

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98. The computer program product of claim 97, further comprising: a tenth set of instructions executable on said computer system, configured to:

if said response to said restoration request is received, release resources of said virtual path.

99. The computer program product of claim 93, further comprising: a sixth set of instructions executable on said computer system, configured to:

if said intermediary node receives a message of a remote port failure at a node comprising said virtual path, change a state of said virtual path to down, forward said message to a plurality of adjacent nodes comprising said virtual path, and initiate a timer for receiving a response to said forwarded message.

100. The computer program product of claim 99, further comprising: a seventh set of instructions executable on said computer system, configured to:

if said timer expires before said response to said forwarded message is received, release resources of said virtual path.

101. The computer program product of claim 100, further comprising: an eighth set of instructions executable on said computer system, configured to:

if said response to said forwarded message is received, release resources of said virtual path.

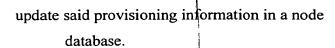
	102. The computer program product of claim 93, further comprising:
	a sixth set of instructions executable on said computer system,
	configured to:
	if said intermediary node receives a valid restore path request,
5	updating path information in a node database,
	allocating resources requested for said virtual path, and
	forwarding said restore path request to all eligible
	adjacent nodes.
	103. The computer program product of claim 93, further comprising:
10	a sixth set of instructions executable on said computer system,
	configured to:
	if said intermediary node receives an invalid restore path
	request,
	respond with an egative acknowledgment.
15	104. The computer program product of claim 84, wherein said restoring of
	said virtual path is performed by said-second node.
	105. The computer program product of claim 104, further comprising:
	a sixth set of instructions executable on said computer system,
	configured to:
20	if said failure is a local physical port failure between said
	second node and an adjacent node comprising said
	virtual path,
	determine an available different physical port of said
	link between said second node and said adjacent
25	nodes,
	initiate a physical port switch request for said adjacent
	node,
	provision said virtual path to said different physical
	port, and
	}

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106. The computer program product of claim 105, further comprising: a seventh set of instructions executable on said computer

system, configured to:

if different physical port of said link between said second node and said adjacent nodes is/unavailable,

- a. change a state of said/virtual path to down,
- b. generate a restoration request,

c. forward said restoration request to a plurality of adjacent nodes comprising said virtual path, and

- d. wait for a response to said restoration request for a predetermined interval of time.
- 107. The computer program product of claim 106, further comprising: an eighth set of instructions executable on said computer system, configured to

if said response to said restoration request is not received within said predetermined interval of time, repeat steps (b) – (d) for a predefined threshold times.

108. The computer program product of claim 107, further comprising: a ninth set of instructions executable on said computer system, configured to:

if said response to said responsition request is not received within said predefined threshold times, release resources of said virtual path.

109. The computer program product of claim 107, further comprising: a ninth set of instructions executable on said computer system, configured to:

if said response to said restoration request is received, release resources of said virtual path.

	110. The computer program product of claim 104, further comprising:
	a sixth set of instructions executable on said computer system,
	configured to:
	if said second node receives a message of a remote port failure
5	at a node comprising said virtual path,
	acknowledge said message,
	change a state of said virtual path to down, and
	release resources of said virtual path.
	/
	111. The computer program product of claim 104, further comprising
10	a sixth set of instructions executable on said computer system,
	configured to:
	if said second node receives a valid restore path request,
	update path information in a node database, and
	allocate resources requested for said virtual path.
	/ / \
15	112. The computer program product of claim 104, further comprising
	a sixth set of instructions executable on said computer system,
	configured to:
	if said second node receives an invalid restore path request,
	respond with a negative acknowledgment.
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20 113.
means f

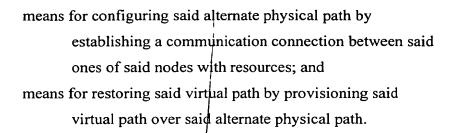
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113. A computer system comprising:

means for broadcasting a plurality of resource request packets to a plurality of nodes in a optical network;

means for identifying a plurality of nodes with resources
wherein said nodes with resources are ones of said
nodes having a resource necessary to support a virtual
path;

means for determining an alternate physical path, said alternate physical path comprising ones of said nodes with resources;



- 114. The computer system of claim 113, further comprising: means for detecting a failure in said virtual path by receiving a failure message.
- 115. The computer system of claim 114, further comprising: means for receiving a failure message packet; means for acknowledging said failure message packet; and means for determining said nodes with resources is done by analyzing a/response to said resource request packets.
- said virtual path is provisioned on a physical path between a first and a second node of said optical network; said physical path between said first and said second node comprises a plurality of intermediate nodes; said optical network comprises said nodes; and each one of said nodes is coupled to at least one another of said nodes by a plurality of optical links.
 - 117. The computer system of claim 116, wherein each one of said nodes is coupled to at least one another of said nodes in a mesh topology.
- 118. The computer system of claim 117, wherein said means for restoring of said virtual path by is included in said first node.

The computer system of claim 118, further comprising: 119. means, if said failure is a local physical port failure between said first node and an adjacent node, for determining an available different physical port of said link between said first node and said adjacent nodes, initiating a physical port switch request for said adjacent node, provisioning said virtual path to said different physical port, and updating said provisioning information in a node database. The computer system of claim 119, further comprising: 120. means, if different physical port of said link between said first node and said adjacent nodes is unavailable, for (i) changing a state of said virtual path to restoring.

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bandwidth for said virtual path, and
(iv)waiting for a response for said path restoration
request for a first predetermined time interval.

(ii) identifying a plurality of adjacent nodes with

(iii) forwarding a path restoration request to said

required bandwidth for said virtual path,

plurality of adjacent nodes with required

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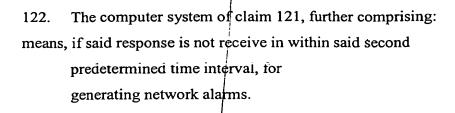
121. The computer system of claim 120, further comprising: if said response to said path restoration request is not received within said first predetermined time interval, means for repeating steps (ii) – (iv) for a second predetermined time interval.

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123. The computer system of claim 119, further comprising: means, if said failure did not occur at a physical port of said link between said first node and one of adjacent nodes of said first node, for

(i) changing a state of said virtual path to restoring,

(ii) identifying a plurality of adjacent nodes with required bandwidth for said virtual path,

(iii) forwarding a path restoration request to said plurality of adjacent nodes with required bandwidth for said virtual path, and

(iv) waiting for a response for said path restoration request for a first predetermined time interval.

124. The computer system of claim 123, further comprising: if said response for said path restoration request is not receive within said first predetermined time interval, means for repeating steps (ii) – (iv) for a second predetermined time interval.

125. The computer system of claim 124, further comprising: means, if said response for said path restoration request is not received with in said second predetermined time interval, for generating network alarms.

126. The computer system of claim 117, wherein said restoring of said virtual path is performed by one of said intermediate nodes.

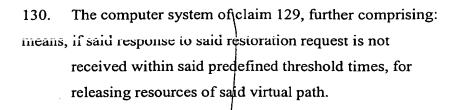
127. The computer system of claim 126, further comprising:
means, if said failure is a local physical port failure between
said intermediary node and an adjacent node comprising
said virtual path, for
determining an available different physical port of said
link between said intermediary node and said
adjacent nodes,
initiating a physical port switch request for said adjacent
node,
provisioning said virtual path to said different physical
port, and
updating said provisioning information in a node
database.
-d

- 128. The computer system of claim 127, further comprising: means, if different physical port of said link between said intermediary node and said adjacent nodes is unavailable, for
 - a. changing a state of said virtual path to down,
 - b. generating a restoration request,
 - c. forwarding said restoration request to a plurality of adjacent nodes comprising said virtual path, and
 - d. waiting for a response to said restoration request for a predetermined interval of time.
- 129. The computer system of claim 128, further comprising: means, if said response to said restoration request is not received within said predetermined interval of time, for repeating steps (b) (d) for a predefined threshold times.

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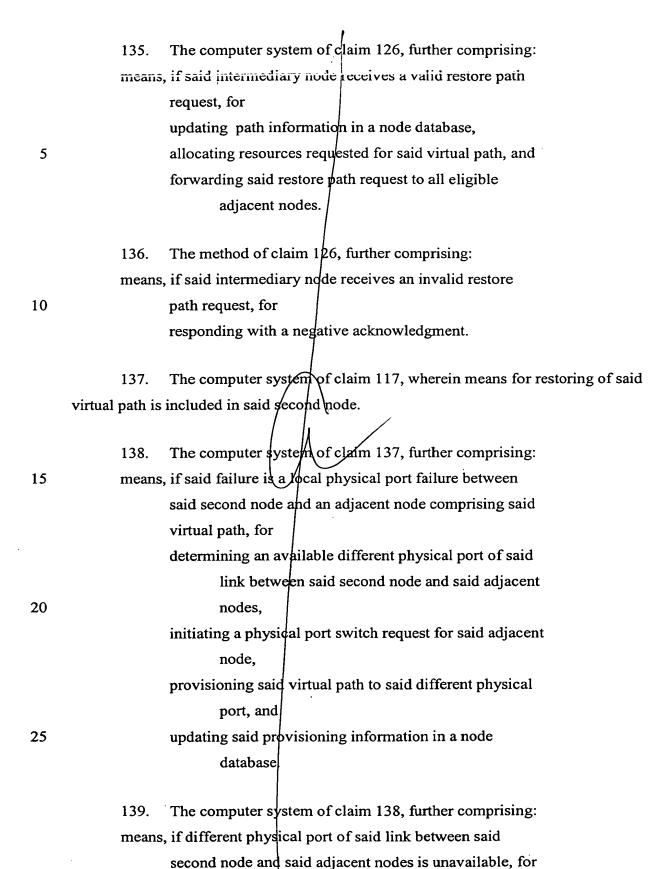


131. The computer system of claim 129, further comprising: means, if said response to said restoration request is received, for releasing resources of said virtual path.

132. The computer system of claim 126, further comprising: means, if said intermediary node receives a message of a remote port failure at a node comprising said virtual path, for changing a state of said virtual path to down, forwarding said message to a plurality of adjacent nodes comprising said virtual path, and initiating a timer for receiving a response to said forwarded message.

133. The computer system of claim 132, further comprising: means, if said timer expires before said response to said forwarded message is received, for releasing resources of said virtual path.

134. The computer system of claim 132, further comprising: means, if said response to said forwarded message is received, releasing resources of said virtual path.





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- changing a state of said virtual path to down,
- b. generating a restoration request,
- torwarding said restoration request to a plurality of adjacent nodes comprising said virtual path, and
- d. waiting for a response to said restoration request for a predetermined interval of time.
- The computer system of claim 139, further comprising: 140. means, if said response to said restoration request is not received within said predetermined interval of time, for repeating steps (b) - (d) for a predefined threshold times.
- The computer system of claim 140, further comprising: 141. means, if said response to said restoration request is not received within said predefined threshold times, for releasing resources of said virtual path.
- The computer system of claim 140, further comprising: 142. means, if said response to said restoration request is received, for releasing resources of said virtual path.
- The computer system of claim 137, further comprising: 143. means, if said second node receives a message of a remote port failure at a node comprising said virtual path, for acknowledging said message, changing a state of said virtual path to down, and releasing resources of said virtual path.
- 144. The computer system of claim 137, further comprising: means, if said second node receives a valid restore path request, updating path information in a node database, and allocating resources requested for said virtual path.

145. The computer system of claim 137, further comprising: means, if said second note receives an invalid restore path request, for responding with a negative acknowledgment.